of his other observations, we should have expected him in this case to have procured some of this scarlet fluid for examination, and also to have obtained permission to place both birds in the same pen; but we have said enough to show that his book seldom lays itself open to criticism of this kind, and we sincerely hope that it will, in the words of its concluding sentence, "find favour with the public," not only because it well deserves to do so, but also because the author promises that if it does, other Series of similar Zoological Notes will be issued by him from time to time. Lastly, we must not take leave of this, the First Series, without noticing the life-like drawings of the illustrations —particularly that of the cobra—and also the novel and effective character of the binding, the boards being covered with thin but continuous plates or shavings of wood, which, without at all adding to their stiffness, give so strikingly pretty a finish that we should like to see this new idea in book-binding largely adopted by other publishers.

GEORGE J. ROMANES

THE GOLD COAST

To the Gold Coast for Gold. By Richard F. Burton and Verney Lovett Cameron. Two Vols. Maps and Illustrations. (London: Chatto and Windus, 1883.)

THE exploration undertaken by Captains Burton and Cameron was for the purpose of examining and reporting upon the condition and prospects of certain gold-mining properties in Western Africa, for which early in 1882 upwards of seventy distinct concessions had already been obtained from various native owners. Five only out of these concessions are reported on as having upon them mines actually in operation, while it is more than probable that of the remaining sixty-five a large proportion might be acquired by the British public for a valuable consideration.

It had originally been intended to explore the so-called Kong Mountains, relative to which no additional information has for many years been acquired; but so much work had to be accomplished on the Ancobra river that the latter portion of the programme had of necessity to be relinquished; under this disappointment Capt. Burton philosophically consoles himself with the reflection that "Geography is good but Gold is better.'

Capt. Burton left Trieste on November 18, 1881, for Gibraltar, and thence proceeded to Madeira, about which he very pleasantly gossips through some sixty pages, and where he is joined, on January 8, 1882, by his travelling companion, Capt. Cameron. From Madeira they proceed together to Teneriffe, *à propos* of which place we are given the translation of a Spanish account of the repulse of Lord Nelson from Santa Cruz de Teneriffe, which extends through at least another fifty pages.

From Teneriffe the travellers continued their voyage, touching at Bathurst, Sierra Leone, Cape Palmas, &c., eventually landing at Axim on January 24, 1882. Of Axim Capt. Burton says:—

> "There is no better landing-place than Axim upon this part of the African coast. The surf renders it impracticable only on the few days of the worst weather. We hugged the north of the Bobowusúa rock-islet. When the water here breaks there is a clear way further north; the southern passage, paved with rocks and shoals, can be used only when the seas are at their smoothest. A regular and well-defined channel placed us on the shingly and sandy beach. We had a succulent breakfast with Messrs. Gillet and Selby (Linott and Spink), to whose unceasing kindness and hospitality we afterwards ran heavily in debt. There we bade adieu to our genial captain and our jovial fellow-travellers."

From Axim the travellers visited a stretch of country in the vicinity of the coast, extending some distance west of that town, and Prince's River to the east of it; and then ascended the Ancobra as far as Tumentu, situated about twenty-two miles from its mouth. After inspecting this last locality Capt. Burton returned to Madeira, leaving Capt. Cameron to continue his surveys inland as far as Crockerville, a mining settlement about forty-five miles north-east of Axim. Capt. Cameron left the African coast on March 28, 1882, and having picked up Capt. Burton at Madeira they proceeded together to Liverpool.

Rich alluvial deposits as well as auriferous quartz reefs are described as occurring abundantly, but the hydraulicing of the former is strongly recommended in preference to the mining and crushing of the latter. This opinion is so constantly reiterated that the explorers would appear to believe that a large portion of the "Dark Continent" would pay for washing. Water is stated to be plentiful, and facilities for hydraulic mining are represented as being very general.

> "Wherever *catas* or 'women's washings' are found we can profitably apply the hydraulic system of sluicing and fluming, not by an upper reservoir only, but also from below, by a force pump. Water is procurable at all seasons by means of Norton's Abyssinian tubes, and the brook-beds dammed above and below will form perennial tanks."

In California as much as fifteen hundred and seventy cubic feet, or forty-three tons of water, under a pressure of four hundred feet, are sometimes discharged per minute from a single nozzle; it is therefore evident that any supply to be obtained from Abyssinian tubes, and pumped against an auriferous bank, would, in comparison with such a power as that described, possess only the force of an ordinary garden squirt.

About five-sixths of the letterpress are from the facile pen of Capt. Burton, the remainder being contributed by his companion, who appears to have done good work by determining the position of various places, of which the exact situation was previously unknown. Collections of plants and birds were also made.

Although somewhat diffuse, these volumes contain much information very pleasantly conveyed, but even in the case of gold-mining, caution is often to be recommended.

OUR BOOK SHELF

A Handbook of Vertebrate Dissection. By H. Newell Martin, D.Sc., M.D., M.A., and William A. Moule, M.D. Part I. How to Dissect a Chelonian. (New York: Macmillan and Co., 1881.)

SINCE the publication of Huxley and Martin's "Elementary Biology," there has been a growing want of more books constructed on the same model. Without such books it is exceedingly difficult for a student to dissect and thoroughly understand the anatomy of an animal which he has never examined before; and though many of the large teaching centres have their own laboratory directions, which, with the help of demonstrators, fulfil all requirements, there are few reliable practical books which can be bought by the private student.

©1883 Nature Publishing Group

Drs. Martin and Moule have lately brought out a pamphlet in which full directions are given "how to dissect a Chelonian," and we are pleased to see from the preface that they intend to follow it by a series of similar works. It is almost a pity that so exceedingly specialised a reptile as a Chelonian should be the first they treat, especially as they intend to include a lizard in the series, for it is doubtless far better to begin the study of reptiles with the latter than with the former.

The species on which the work is based is *Pseudemys rugosa*, but, as Dr. Martin states, "the end in view is not to provide a monograph on any one species, but to show a student 'how to dissect a Chelonian,'" the fact that, when dissecting another species, the description in the book cannot altogether be relied upon, makes the student examine everything carefully for himself.

Without working through the anatomy of a Chelonian with the help of the book it is impossible fully to appreciate its value, but from the arrangement, accuracy, and clearness of description, it will doubtless prove a great boon to the young herpetologist.

The only fault we can find with it is one under which the "Elementary Biology" equally suffers, and that is the want of illustrations. There is a frontispiece with four rather rough woodcuts of the skull (to which no reference letters are given in the text), but this is all.

Of late several illustrated students' biological books, intended as guides for practical work, have been brought out, but most of these are so inaccurate as to be practically useless. It is therefore to be regretted that a book by so eminent a teacher as Dr. Martin should be so poorly provided with figures, and we hope that the rest of the series will be more fully illustrated, as their value would be thereby greatly increased.

Ferns of Kentucky. By John Williamson. (Louisville, Kentucky: J. P. Morton and Co., 1878).

ALTHOUGH this little volume has only just reached us, it cannot be said to be out of date; for the number of popular works on ferns—those published in England excluded—is so small, that an addition to their number is at any time welcome to the fern-lover who has become well acquainted with the common British species, and would gladly increase his knowledge of the tribe. There is, indeed, no parallel in French or German literature to the number of fern-books which have been issued in England; but it would appear from the volume before us that in America fern-hunting is as popular as it is among ourselves; for Mr. Williamson asks in his preface "Who would think now of going to the country to spend a few days, or even one day, without first inquiring whether ferns are to be found in the locality?"

Mr. Williamson has given descriptions of the species found in Kentucky, and the letterpress is accompanied by sixty plates, in which the characters of the genera and the habit of each species is represented. The descriptions, although short and couched in simple language, seem carefully done; and the absence of pretence about the work does not render it the less attractive. Although, of course, primarily intended for local use, the "Ferns of Kentucky" contains much to interest the British lover of ferns.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Hovering of Birds

I AM much obliged to his Grace the Duke of Argyll and to Mr. H. T. Wharton for the notice they have taken of my letter on the hovering of birds. It may be hoped that the question will not be allowed to rest until it has received its quietus at the hands of some mathematician who shall tell us with authority whether it is possible, according to the received laws of mechanics, for a rigid body, by any disposition of its surfaces, to remain motionless (relative to the earth) for a minute in mid-air in a perfectly horizontal wind.

It is disappointing to find that the 3rd chapter of the "Reign of Law," to which the Duke refers me, contains no satisfactory explanation of the phenomenon of motionless hovering. We read there (p. 161, 5th edition, 1868). "When there is a strong breeze, no flapping is required at all, the force of the wind supplying the whole force necessary to counteract the force of gravity." This is hardly a sufficient explanation. Let us imagine a bird at rest in a horizontal wind. Neglecting friction, the only forces acting on the bird are (1) the vertical force of gravity, and (2) the resultant of the air-pressures on the different surfaces of the bird caused by the horizontal velocity of the wind. These pressures may be resolved parallel and perpendicular to the general plane of the wings, and the direction of their resultant will vary with the slope of the wing-plane; but in every case it will lie to rearward of the vertical, and therefore in every case there will be a resolved horizontal force pushing the bird backwards. Yet in spite of this force the bird is to remain at rest! Shade of Archimedes!

Consider, again, what must be the necessary corollary to the Duke's proposition. If a bird can remain at rest in a horizontal wind, it necessarily follows that in still air a bird can float horizontally without losing velocity. We do indeed see rooks and other birds float long distances descending on outspread wings in still air, and it is marvellous how slow is the descent, so great is the resistance of air to a plane-surface when at every successive instant the plane surface covers a fresh body of air that has not yet begun to yield. But no one ever saw a bird maintain a horizontal floating flight in still air. Either the descent is continuous, or the bird loses velocity.

It might be wished, in a matter of such importance, involving as it does nothing less than the establishment of a miracle, that the Duke of Argyll were more precise in his statement, for I feel curious to know by what resolution of forces he would demonstrate the existence of a forward horizontal force to balance the backward force which he cannot deny to be present. A diagram setting forth the Duke's views would be exceedingly welcome. My own diagram, I fear, will not serve his purpose any better than my words, in spite of the attempt he makes to press them into his service. The Duke says: "The bird has only to slope his wing-surfaces to the [horizontal] current, and precisely the same effect is produced as if the current had been otherwise sloped upwards against a horizontal wing-surface." Perfectly true, provided his Grace can tilt the direction of gravity through the same angle. Otherwise not (at the same time there is nothing about a "horizontal wing surface" in my letter).

Mr. Wharton will do good service if, in recording any future observations he will note precisely the local circumstances under which they are made, bearing in mind that such an obstacle as a stack, a barn, a high hedge, or a thick tree might be enough to give the wind an upward throw. I presume he understands that the phenomenon to be explained is that of a bird remaining at rest in mid-air, with wings motionless, not fluttering.

Woodbridge, February 5 HUBERT AIRY

THIS is a very interesting problem, and one which has been very clearly treated by Mr. Hubert Airy, so far as he discusses it.

I think, however, that birds are able to "hover" in other conditions than that he mentions, namely, where the wind is diverted upwards by blowing straight against cliffs or rising ground.

The wind in this country at least is generally of a cyclonic character. Now such wind blows in toward the centre of depression, as has been shown by the Rev. W. Clement Ley, at an average angle of 25 degrees (inward from the tangent to the isobar). If we assume the wind to blow at a distance of 600 miles from such centre at a rate of 20 miles per hour—on an average for one mile in depth—then we have a volume of air converging upon the centre, which must rise into the upper regions there. If we assume, for the sake of obtaining a definite idea of this amount, that the centre of depression covers an area of 70 miles in diameter, say about 4000 square miles, then the air would rise vertically at an average rate of 400 feet per minute over the

©1883 Nature Publishing Group